

measuring seven inches in circumference and the smallest six; the heaviest weighed after the storm  $1\frac{1}{2}$  oz; 640 panes of glass broken at the post, chickens killed, corn and vegetables cut down. Boone Co., Iowa, 8th, storm of rain and hail, causing almost total destruction of crops. St. Thomas, West Indies, 9th and 10th, heavy rains, strong winds, almost a hurricane. Oregon, Mo., 9th, 4 a. m., strong gale from NW., with thunder and lightning, destroying crops, trees, buildings, &c. From 10th to 12th, severe rains in northeastern portion of Iowa, much damage to crops. Chambersburg, Pa., 12th, heavy storm of wind and rain; six miles southwest, very destructive hail-storm. During the night, (11th and 12th,) a severe NE. gale prevailed at the mouth of St. John's River, Fla.; Schr. Sarah R. Thomas broke loose at 11:30 p. m., and after crossing bar went ashore at daylight south of Mayport; at Mayport a very high sea prevailed during morning, and two pilot boats were landed high and dry. At St. Augustine, Fla., p. m. 11th to 7 a. m. 12th, NE. to SE. gale. At Abaco, Bahamas, evening 11th, NE. gale. 14th, Charleston, S. C., severe thunder and hail-storm from 1 p. m. to 2:15 p. m.; rainfall from 1 to 2 p. m. 4 in., and from 2 to 4:30 p. m. 1.13 in., total 5.13 in.; hail at 1:30 p. m. very heavy in low portion of city; wind constantly veering and backing between NE. and SW. by the SE.; max. vel., S. 42 at 1:40 p. m.; in Meeting street seven inches of rain is reported to have fallen in 15 minutes, and the streets in this portion of city were flooded over three feet deep; buildings, shipping, and trees were considerably damaged by wind and lightning. At Tybee Island, Ga., 14th, a heavy NE. gale prevailed from 4:15 to 5 p. m. Scarsdale, N. Y., 21st, severe gale, with hail, uprooting trees and destroying vegetation. Near Cleaveland, Tenn., 31st, heavy wind-storm six miles north of station, peach orchards severely injured.

*Waterspouts.*—June 4th, Denver, Col., water-spout observed up Platte Canyon, about ten miles to the southwest; visible about ten minutes; most damage occurred in vicinity of Littleton; Platte river raised slightly and inundated a portion of railroad track. June 24th, Indianola, at 7:10 a. m., two large waterspouts were observed about three or four miles southeast of station, moving northward over the bay, at about twelve or fifteen miles per hour; they appeared about two or three miles apart; the columns were complete from surface of bay to the clouds and broke up respectively at 7:25 and 7:35 a. m. Mayport, Fla., July 24th, eight miles NE. of station; no progressive motion visible.

## VERIFICATIONS.

*Indications.*—As worked up and issued to the public three times daily, they have been carefully compared with the actual conditions during the succeeding twenty-four hours, with the following result:—the percentage verified averages 80.6 for New England; 77.8, Middle Atlantic States; 83.5, South Atlantic States; 89.8, Eastern Gulf States; 86.7, Western Gulf States; 81.6, Ohio Valley and Tennessee; 84.9, Lower Lake region; 83.1, Upper Lake region; 84.3, Upper Mississippi valley; 82.9, Lower Missouri valley. For all the districts the average verified is 83.7 per cent. By elements the percentage verified averages 86.1 for the weather; 86.8, wind-direction; 81.1, temperature; 80.9, barometer. There were 23 omissions to predict, (8 for weather, 4 for wind-direction, 5 for temperature and 6 for barometer,) out of 3,720, or 0.62 per cent. Of the predictions made, 3.0 per cent are recorded as having completely failed; 3.0 per cent, as one-fourth verified; 14.3 per cent, as one-half verified; 15.3 per cent, as three-fourths verified; 64.4 per cent, as fully verified.

*Cautionary Signals.*—During the month 88 Cautionary Signals were displayed; 67, or 76 per cent., were justified by subsequent hourly velocities of 25 miles or over, at or within 100 miles of the station. Two signals were ordered up late. Sixty-three cases were reported, generally from scattered stations, of winds of 25 miles or over when signals were not ordered.

## NAVIGATION.

*Stages of Water in Rivers.*—In the table, upon the right side of chart No. III, are given the highest and lowest readings of the Signal Service gauges for the month, with the dates. Generally, the changes in the rivers have been gradual and slight. The Cumberland rose three feet on the 2nd and 3rd at Nashville. The Ohio rose 3 feet 5 inches the 18th and 19th at Cincinnati. In the Lower Missouri and Lower Mississippi there has been almost a steady fall throughout the month. The Upper Mississippi rose nearly 4 feet at Dubuque from the 11th to the 13th; over 4 feet at Davenport from the 13th to the 16th; nearly 3 feet at Keokuk from the 14th to the 17th; over 3 feet at St. Louis on the 30th and 31st. At Omaha the channel of river changed during month towards Nebraska shore and is now between piers Nos. 3 and 5. Fort Gibson, 16th, steamer Big Rock arrived from Little Rock, being the first arrival in eight years. Shreveport, navigation good throughout month for largest class of boats. La Crosse, 13th, "water getting so low that navigation is exceedingly difficult." Dubuque, a good boating and rafting stage during month. Savannah river, at Augusta, Ga., 27th, lower than since 1876, forded by man on horseback.

## ATMOSPHERIC ELECTRICITY.

*Thunder-storms.*—1st, Ill., Ind., Mich., Mo., Ohio, Tenn., Tex., Miss., Fla., Ga., S. C. 2nd, Tenn., Va., Ind., N. Y., Ohio, Ga., Va. 3rd, Me., Miss., N. Y., Montana, Mich., W. Va., Ga., Va., Me., Dak., Ohio, S. C. 4th, Conn., Kan., Mass., N. J., N. Y., Pa., Tex., Fla., La., Mo., W. Va., Ga., Utah. 5th, Ill., Kan., Va., Col., Tex., Fla., Ga., Mo., Utah. 6th, Ala., Ill., Mo., Ohio, Tenn., Va., Ind., Nebr., Dak., Tex., Miss.,

La., Iowa, Minn., Ky., Ga. 7th, Ala., Dak., Ind., Nebr., Ohio, Va., Fla., Iowa, Minn., Ill., Ga., Mo., S. C., Tex., Wis. 8th, Ala., Conn., Ind., Kan., Md., Mass., Nebr., N. J., N. Y., Ohio, Pa., Tenn., Va., Wis., Dak., Montana, Ind. Ty., Fla., Minn., Mich., W. Va., Ill., Ky. 9th, Conn., Dak., Del., Kan., Me., Md., Mass., Nebr., N. J., N. Y., Pa., Va., Wis., R. I., Tex., Fla., Ala., Miss., Minn., Mich., Ill., Iowa. 10th, N. Y., Col., Conn., Dak., Iowa, Mass., Mich., N. J., Ohio, Pa., Vt., Va., Montana, Tex., Ala., W. Va., Md., Wy. Ty., Ill., Nebr. 11th, Ala., Col., Ill., Ind., Iowa, Mass., Ohio, Va., Wis., N. M., Dak., Tex., Minn., N. Y. 12th, Col., Del., Ind., Md., N. H., N. J., N. Y., Ohio, Pa., Va., Fla., N. M., Tex., Minn., Dak., Mich., W. Va., Wy. T., Ill., S. C. 13th, Col., Ind., Kan., Miss., Ohio, Va., Dak., Tex., W. Va., Ill., Ky., Fla., Ga., N. C. 14th, Col., Dak., Ia., Kan., Me., Mass., Nev., Tex., Minn., Wis., Mich., Tenn., Ga., S. C., Ill. 15th, Ill., Mass., Fla., Utah, Col., Tex., Dak., Minn., Wy. Ty., Ia. 16th, Dak., Va., Neb., Kan., Fla., Minn., Wis., Mich., Ia. 17th, N. Y., Ill., Ind., Kan., Me., Mich., Mo., N. H., Vt., Va., Wis., Fla., Ia. 18th, Dak., Ind., Mass., N. H., N. J., N. Y., Ohio, Pa., Va., Ill., Tex., Minn., Ia., Mich., Ky., Ga., Mo., Neb. 19th, Col., Ia., Md., N. J., N. C., Pa., Tenn., Va., Dak., N. M., Tex., Fla., W. Va., S. C., Mass., Ill., Mo., Neb. 20th, Col., Fla., Ill., Md., Neb., N. Y., Ohio, Tenn., Va., R. I., Ind., Wy. Ter., N. M., Ala., Ga., Ia. 21st, N. Y., Col., Conn., Kan., Me., Md., Mass., N. H., N. J., N. C., Pa., Tenn., Vt., Va., La., Ga., R. I., S. C., Tex. 22nd, Col., Dak., Miss., Va., Wy. Ter., Mont., Fla., Tex., S. C., Ga., Utah. 23rd, Col., Dak., Kan., Vt., Utah, Nev., Mont., Tex., Ala., La., Fla., N. H., Wy. Ter., Neb. 24th, Col., Kan., Fla., Mont., Tex., Wy. Ter., Ia. 25th, Col., Kan., N. H., Wis., Fla., Utah., Wy. Ter., Neb., Minn., Ia. 26th, Col., Ga., Ill., Ind., Mo., N. Y., Tenn., Ind. Ter., Tex., Ala., Fla., Ia., Ky., Utah. 27th, Col., Ga., N. C., Tenn., Va., N. M., Neb., Dak., Tex., Ala. 28th, Ga., Kan., Neb., N. C., Tenn., Va., Dak., Tex., Ala., Miss., La., Mo. 29th, Dak., Del., Ga., N. C., Ohio, Pa., Tenn., Va., Fla., Minn., W. Va., Ill., Md., N. J., Tex. 30th, Ala., Ind., Neb., N. J., Ohio, Va., Kan., Minn., Mo., Mich., Ga., Ill., Ia., S. C. 31st, Dak., Ill., Ind., Ia., Mich., N. J., Ohio, Va., Ala., Tex., W. Va., Ga., S. C., N. C., Md., Neb.

*Auroras*.—Clear Creek, Neb., 1st, 2nd, 3rd; Milwaukee, Wis., 15th; Flushing, N. Y., 25th; Vevay, Ind., 21st, 31st.

*Magnetic Phenomena*.—Prof. G. Hinrichs, Iowa City, Iowa, reports the average magnetic diurnal range in declination as 8.7 minutes.

*Telegraphic communication interfered with by Atmospheric Electricity*.—Santa Fe, 5th, 15th, 17th, 18th, 21st, 24th; 11th, severe thunder-storm, telegraphic instruments cut out; 12th, severe thunder-storm, lines worked with difficulty; 19th, 20th, 27th, severe thunder-storm, wires cut out. Concho, Tex., 13th, 14th, 26th. Griffin, Tex., 26th. Laredo, Tex., 25th. Boerne, Tex., 26th to 29th. Burlington, Iowa, 31st. Pembina, Dak., 6th, electricity intense, wires entirely unmanageable, "sparks from switch-board to lightning arrester two feet in length; 18th, instruments and wires completely unmanageable, continually emitting sparks, although cut out, lightning arrester fused; at Grand Forks wires were burned up; 25th, earth currents very strong, interfered with lines; 29th to 31st, electrical disturbance continued throughout entire days. Sandy Hook, N. J., 9th, 21st.

## OPTICAL PHENOMENA.

*Solar Eclipse*.—A summary of the observations of the Solar Eclipse of July 29th will appear in the REVIEW for August.

*Solar Halos*.—1st, Tex. 3rd, Ohio. 4th, Ohio, S. C. 5th, Ohio, Miss. 6th, Ala., R. I., Ind., Miss., Ohio. 7th, Ala., La., Ohio, Ga., Ind., Miss. 8th, Ohio, Neb. 9th, Ill., Pa. 10th, Ill. 11th, Ohio, Ill., N. H., N. Y. 12th, Ala., Ohio, Ga., N. H. 13th, Ga. 16th, Neb., N. Y., R. I., Conn., N. H. 19th, Ill., N. Y. 20th, Ohio, Fla., Ill., Ind. 21st, Dak. 22nd, Ohio. 23rd, Ill., Mo. 25th, Ohio, N. Y., R. I., Conn. 26th, Ga., Ohio. 27th, N. Y. 28th, Tex., S. C., Ill., Ind., Mich., N. Y., Ohio, Pa. 29th, Tex., S. C., N. Y., R. I., Conn., Mass., N. H., Me., Vt. 30th, Fla., Ohio, Wis. 31st, N. Y.

*Lunar Halos*.—3rd, Ind. 4th, Tex., Ind. 5th, Tex., N. Y., Ohio. 7th, Tex., La., Ohio. 7th, Tex., S. C., Dak. 8th, Tex., Iowa, Ga., Va., Ohio, Utah. 9th, Kan., Tex., Ala., Mo., Ky., Ohio. 10th, Col., Tex., La., Mo., Pa., Ky. 11th, Tex., La., Mo., Minn., Ohio, N. C. 12th, Cal., Tex., Fla., Mo., Ohio. 13th, Tex., Ga., Mo., Va. 14th, Minn., Mich. 15th, Dak., Iowa, Minn., Ohio. 16th, Mich., N. Y., N. J., Me., Tenn. 17th, Ga., N. C., Va. 18th, Ohio, Conn. 19th, N. Y., Ohio. 20th, Tex., Iowa.

*Mirage*.—New Haven, Conn., 31st, over Long Island Sound.

*Miscellaneous*.—On the 2nd, at Tybee Island, Ga., 5 p. m., "a double rainbow was observed in an apparently cloudless sky." 29th, at Louisville, Ky., "the following curious phenomenon was observed during the solar eclipse:—a bow, almost complete and somewhat similar to a rainbow, formed on the translucent clouds about 10° west of zenith, in the reverse position to that of a rainbow; had the circle been complete, the zenith would have been near the centre." Lieut-Commander Chas. H. Craven, U. S. Navy, observer at U. S. Navy Yard, Mare Island, Cal., reports as follows:—"June 7th—although the sky was completely overcast, the hills and all objects on them were completely visible. I could distinguish trees (single) at more than twenty miles, and see the chimneys and windows in houses over eighteen miles; even the posts and rails of fences could be counted at eight or ten miles to the eastward."

## MISCELLANEOUS PHENOMENA.

*BOTANICAL*.—*Alabama*—1st, in northern portion of state, wheat crop seriously cut off by rust; cotton generally good, and blooming well, some abandoned on account of successive rains; corn crops fine. These conditions also obtain in western Tennessee, northern Mississippi and northern Arkansas. *Canada*—11th,